

Examiner's suggestion made during the above referenced telephone conversation. The Applicants respectfully submit that this Amendment to the description of the drawings in the specification overcomes the Examiner's Objection to Figure 1.

Claim Objections

2. The Examiner's objections to Claims 1-10 because of the listed informalities in Claims 1, 2, 6 and 7 has been studied and appropriate corrections have been made to these Claims as suggested by the Examiner. "Shocked" has been changed to -- shock-- in accordance with the Examiner's suggestion thereby overcoming the Examiner's objections to Claims 1-10.

Claim Rejection - 35 USC §112

3. The Examiner's rejection of Claims 2-5, 7-9, 12-14 and 17-19 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention has been carefully studied and the Applicants have made the Amendments above to the appropriate Claims to overcome this Rejection by changing the singular element "region" to --regions-- in the independent Claims from which the others depend, thus, eliminating any ambiguity in the Claims. The Applicants respectfully submit that these Amendments overcome the Examiner's rejection of Claims 2-5, 7-9, 12-14 and 17-19 under 35 U.S.C. 112, second paragraph, and that these Claims as well as all other Claims in the present case are in condition for allowance.

Claim Rejection - 35 USC §102(e)

4. The Examiner's rejection of Claims 1-8, 11-13 and 16-18 under 35 U.S.C. 102(e), as being clearly anticipated by Mannava 5,591,009 ('009), has been carefully studied and the Applicants have amended these Claims to positively recite a compressor airfoil in the body of the claim and not rely on

the preamble for this aspect of the elements claimed.

Therefore, it is submitted that the Amendments to the Claims above overcome the Examiner's rejection of Claims 1-8, 11-13 and 16-18 under 35 U.S.C. §102(e).

Claim Rejection - 35 USC §103(a)

5. The Examiner's rejection of Claims 9-10, 14-15 and 19-20 under 35 U.S.C. §103(a), as being unpatentable over Mannava 5,591,009, in view of Neal et al. 4,426,867, has been carefully considered by the Applicants and the Applicants respectfully disagree. The Applicants respectfully submit that the Mannava '009 patent is not available to the Examiner as a "103" reference because the Mannava '009 patent was filed (January 17, 1995) after an Invention Disclosure entitled "Enhanced Compressor Blade for Aircraft Engines" signed by the Applicants was disclosed to the Applicants' employer and based upon which the Parent Application, Serial No: 08/399,285, of the present Patent Application was filed (March 6, 1995). A "DECLARATION UNDER 37 C.F.R. 1.131(b)" signed by the Applicants is submitted herewith supporting this position. The Declaration states that the Applicants invented the present invention prior to the effective or filing date of the Mannava '009 patent. Therefore, the Applicants respectfully submit that the Examiner's rejection of Claims 9-10, 14-15 and 19-20 under 35 U.S.C. §103(a), as being unpatentable over Mannava, in view of Neal, has been overcome by the remarks above and the attached 1.131(b) Declaration and should be withdrawn.

Claim Rejection - 35 USC §103(a)

6. The Examiner's rejection of Claims 1-8, 11-13 and 16-18 under 35 U.S.C. §103(a), as being unpatentable over Neal et al. (Neal), in view of the American Machinist article (Am. Mach.) entitled "Laser Shocking Extends Fatigue Life", and the Examiner's rejection of Claims 9, 10, 14, 15, 19 and 20 under

35 U.S.C. §103(a), as being unpatentable over Neal, in view of the Am. Mach., and further in view of Fraser has been carefully considered by the Applicants and the Applicants respectfully disagree. The depth limitation of the compressive residual stresses of the present invention more clearly defines and points out the nature of the compressive residual stresses imparted by the laser shock peening process and points out that they are deep stresses and far stronger forces are used than taught by Neal, and which in effect Neal teaches away from. Laser shock peening is an explosive process as understood in the art and as used herein and the prior art has not shown laser shock peening to be interchangeable with or the equivalent of shot peening. Laser shock peening uses a laser beam to produce a strong localized compressive force on a portion of a surface. The laser beam is fired through a curtain of flowing water that is flowed over a painted surface and the paint is ablated generating plasma which results in shock waves on the surface of the material. These shock waves produce forces that act normal to the surface of edges of the airfoil and, therefore, directly away from the teaching of Neal which desires the impact of the shot, due to gravity shot peening, to be at a maximum oblique angle to the tangent of the edge surface which is designed to lessen the peening force to avoid deformation. Neal clearly teaches directly away from both the Am. Mach. reference and the teaching of the present invention. Neal clearly teaches and warns away from using a direct force normal to the surface being peened as is done in the present invention.

The Examiner stated that there is no requirement that a motivation be expressly articulated in prior art and the test for combining references is what the combination of the disclosures taken as a whole would suggest to one of ordinary skill in the art. However the Examiner fails to take into account that Neal expressly states that normal shot peening damages the leading edge surface and that Neal teaches to

lessen the blow by directing the shot at an oblique angle to a tangent of the surface. This teaching of Neal, when taken with the rest of the whole of the prior art, clearly teaches one not to use the teaching in the Am. Mach. reference to peen an edge of a compressor airfoil.

Therefore, the Applicants respectfully submit that it would not have been further obvious at the time the invention was made to a person having ordinary skill in the art to apply the laser shock peening as taught in the Am. Mach. reference to the blade of Neal. The Examiner cites *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980), *In re Aller*, 105 USPQ 233, 235 (CCPA 1955), and *In re Woodruff* 16 USPQ 2d 1934, 1936 (Fed. Cir. 1990) to support his contention regarding the recitation of the residual compressive stresses extending in the range of 25-50 mils and that it would have been obvious to a person of ordinary skill in the art to select the intensity of the shock peening such that the residual compressive stresses extend in the range of 25-50 mils since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. However, in the present case the differences between shot peening and laser shock peening are considerable and not merely a difference in the ranges. The Woodruff case clearly stated:

"Like Woodruff's method, McGill's method consists of storing the vegetables in a modified atmosphere and at a lower temperature. As can be seen, except for the carbon monoxide concentration, all of the ranges of gas concentrations and temperature set forth in the McGill patent are completely within those recited in claims 27 and 31. With respect to the CO concentration, there is an overlap between the percentages of the McGill patent and claim 27, while the percentages of the McGill patent and claim 31 are roughly contiguous."

This clearly is not the case in the present invention with respect to the prior art. Woodruff claimed a "new use"

(preventing fungal growth) that was found by the court to be at least generically encompassed by the prior art purpose of preventing the deterioration of leafy and head vegetables. The cases cited by the Examiner as explained by the court in Woodruff are cases in which the difference between the claimed invention and the prior art is some range or other variable within the Claims. That is not the case here. Here, the difference is between a shot peened edge and a laser shock peened edge and a difference in ranges. Furthermore, the range of the present invention goes beyond that taught by the Neal reference and beyond that apparently warned against in the Neal reference.

The Applicants respectfully submit that the Examiner's combination of prior art and subsequent rejection have been overcome by the amendments and remarks above and that the present Claims are patentable over the combination of cited references because of the differences between the prior art and the Claims at issue. The prior art itself not only fails to teach a particular combination which results in the claimed invention, but in fact, teaches away from and warns against the present invention and is inconsistent with the purposes of the present invention.

Furthermore, the Applicants respectfully suggest the Examiner broke the invention into its constituent elements, found each element of the invention in the prior art, and then claimed it would have been obvious for one of ordinary skill in the art to reassemble those elements into the invention; all of which constitutes the forbidden hindsight reconstruction in analyzing obviousness. *In re Mahurkar, Double Lumen Hemodialysis Catheter Patent Litigation*, 831 F. Supp. 1354, 1374-75, 28 U.S.P.Q. 2d 1801 (N.D. Ill. 1993).

The Am. Mach. article makes no reference to treating compressor airfoil edges and Neal desires the impact of the shot, due to gravity shot peening, to be at a maximum oblique angle to the tangent of the edge surface which is designed to

lessen the peening force to avoid deformation, which directly contradicts both the Am. Mach. reference and the teaching of the present invention. The present invention uses much greater stress level to far greater depths than the Neal patent which the Neal patent teaches away from and seeks to avoid. The obliqueness of the shot hits in Neal lowers the impact energy and residual compressive stress levels and, thus, would teach a person skilled in the art to stay away from the force of laser shock peening of the present invention and that of the Am. Mach. reference.

The present invention provides laser beam shock induced deep compressive residual stresses extending into the airfoil from the laser shock peened surface to a depth in a range of about 20-50 mils into the laser shock peened regions. There is no indication this is shown in the Neal reference and, in fact, it would appear that Neal is teaching away from these levels and, therefore, away from laser shock peening edges of blade airfoils. In column 5, line 19, Neal clearly shows that he is using the obliqueness on edge impacts to limit and maintain far lower levels of compressive residual stresses than that found in the present invention and in the Am. Mach. reference and which is directly contrary to the present invention and the Am. Mach. reference both in product, process and purpose.

The Examiner has also not shown that the prior art references have the same purposes as each other or as the present invention. References may be combined to establish the obviousness of a claimed invention if some objective teaching exists in the prior art or if knowledge is generally available to one of ordinary skill in the pertinent art that would lead one to combine the relevant teachings of the references, *In re Fritch*, 972 F.2d 1260, 1265, 23 U.S.P.Q. 2d 1780 (Fed. Cir. 1992). The Applicants respectfully submit that the Examiner has not shown the basic elements of the Claims to be in the prior art or that such knowledge is

generally available to one of ordinary skill in the pertinent art. Additionally, the court in Fritch states that the prior art may not be modified absent some teaching or suggestion in the prior art supporting the modification. The mere fact that the prior art may be modified to make it more like the claimed invention does not render the invention obvious unless the prior art suggested the desirability of such a modification. The Examiner has used impermissible hindsight to combine references and attributed it to knowledge of one of ordinary skill in the art without any proof or any showing in the prior art that such is the case.

Therefore, the Applicants respectfully submit that the Examiner's rejection of amended Claims 1-20 under 35 U.S.C. 103(a), has been overcome by the amendments and remarks, because of the absence of features of the presently claimed invention, because there has been nothing, not even a suggestion, shown in the prior art as to why the references should be combined as done by the Examiner and because it appears that the Neal reference teaches away from both the present invention and the Am. Mach. reference.

Double Patenting

7. The Applicants have now studied the Examiner's obvious type Double Patenting rejections of Claims 1-20 under the judicially created doctrine of double patenting over Claims 1, 1, 3, 1, 3, 1, 1, 3, 4, 4, 1, 1, 3, 4, 4, 1, 1, 3, 4, and 4, respectively, of U.S. Patent No. 5,591,009 and over Claim 1, respectively, of U.S. Patent No. 5,531,570 in light of the above amendment to the present Claims and the withdrawal of rejections from the previous office actions. The Applicants respectfully submits that the amendments to the Claims above and the remarks below overcome the Examiner's obvious type Double Patenting rejections of Claims 1-20.

In re Goodman, 29 USPQ 2d 2010 (CA FC 1993) clearly states that "To prevent extension of the patent right beyond

statutory limits, the doctrine of obviousness-type double patenting rejects application claims to subject matter different but not patentably distinct from the subject matter claimed in a prior patent. *In re Braat*, 937 F.2d 589, 592, 19 USPQ 2d 1289, 1291-92 (Fed. Cir. 1991)." The Applicants submit that the present Claims are patentably distinct from the subject matter claimed in both of the references cited by the Examiner. The Claims in Mannava '009 are to a fan blade not a compressor airfoil as in the present invention. Furthermore, the '009 patent has a limitation of the portion containing the laser shock peened region being centered about an intersection of the leading edge and a predetermined nodal line of the blade. Clearly, these two distinctions and limitations of the '009 patent are patentably distinct from the subject matter of the present Claims which have no limitation regarding nodal line and are compressor airfoils and blades not fan blades.

The same reasoning applies to the Mannava '570 patent. Mannava '570 has a limitation not found in the present invention, namely a means to counter distortion. Furthermore, since the '570 patent was filed after the parent of the present Application a different test is applied. *In re Goodman* also states that in certain circumstances, an additional inquiry to support the double patenting obviousness rejection is required. The two prongs of the test provide that a double patenting obviousness rejection will only be sustained if the application Claims are not patentably distinct from the prior patent Claims, and the prior patent Claims are also not patentably distinct from the application Claims. The court stated that "This "two-ways" analysis is necessary because a later-filed improvement patent may issue before an earlier-filed basic invention."

The prior patent Claims, those of '570, are patentably distinct from the Claims of the present application Claims because there is not even a suggestion in the present

invention or any art cited against it to use a means to counter distortion and laser shock peening of the compressor airfoil edges.

Therefore, the Applicants respectfully submit that the Examiner's obvious type Double Patenting rejections of Claims 1-20 have been overcome by the amendments and remarks.

8. The Applicants respectfully submit that Claims 1-20 are now in condition for allowance based on the amendments and remarks above.

Respectfully submitted,



Steven J. Rosen
Attorney for the Applicants
Reg. No. 29,972

February 20, 1998

General Electric Company
1 Neumann Way - MD H17
Cincinnati, OH 45215-6301

Phone: (513) 243-8925
Alt: (513) 489-5383
FAX: (513) 489-5466